Chapter

12

POLLUTANT LOADING AND REMOVAL ESTIMATES

INTRODUCTION *12.1*

This chapter presents annual pollutant loading and removal estimates for the CWT industry associated with each of the subcategories and regulatory options considered by EPA in developing the effluent limitations and pretreatment standards. EPA estimated the pollutant loadings and removals from CWT facilities to evaluate the effectiveness of different treatment technologies and to evaluate how costly these regulatory options were in terms of pollutant removals. EPA also used this information in analyzing potential benefits from the removal of pollutants discharged to surface waters directly or indirectly through publicly owned treatment works (POTWs). EPA estimated raw, current, and post-compliance pollutant loadings and pollutant removals for the industry using data collected from the industry throughout development of the rule. This assessment uses the following definitions for raw, current, and post-compliance pollutant loadings:

- Raw loadings -- For the metals and organics subcategory, raw loadings represent CWT waste receipts, that is, typically untreated wastewater as received from customers. For the oils subcategory, raw loadings represent the effluent from the initial processing of oil bearing, CWT waste receipts, that is, effluent from emulsion breaking and/or gravity separation.
- Current loadings -- These are the pollutant loadings in CWT wastewater that are currently being discharged to POTWs and surface waters. These loadings account for wastewater treatment currently in place at CWT facilities.
- Post-compliance loadings -- These are the pollutant loadings in CWT wastewater that would be discharged to POTWs and surface waters upon compliance with the rule. EPA calculated these loadings assuming that all CWT facilities would achieve treatment at least equivalent to that which may be achieved by employing the technology option selected as the basis of the limitations or standards.

The following information is presented in this chapter:

- Section 12.2 summarizes the data sources used to estimate pollutant loadings and removals;
- Section 12.3 discusses the methodology used to estimate current loadings;
- Section 12.4 discusses the methodology used to estimate post-compliance pollutant loadings;
- Section 12.5 discusses the methodology used to estimate pollutant removals;
- Section 12.6 presents the pollutant loadings and removals for each regulatory option, including current and post-compliance pollutant loadings.

DATA SOURCES *12.2*

As previously explained in Chapter 2, EPA primarily relied on four data sources to estimate pollutant loadings and removals: industry responses to the 1991 Waste Treatment Industry Questionnaire, industry responses to the Detailed

Monitoring Questionnaire, wastewater sampling data collected by EPA, and data provided in comments to the proposals. Chapter 2 of this document discusses each of these data sources in detail.

METHODOLOGY USED TO DEVELOP CURRENT LOADINGS ESTIMATES 12.3

EPA calculates current loadings for a specific facility using the effluent flow rate of the facility and the concentration of pollutants in its effluent obtained from effluent monitoring data. EPA does not have data for every facility in the database to calculate current loadings. For some, EPA has no effluent monitoring data, while for others, EPA may have only limited monitoring data for a few parameters. In some cases, EPA has effluent monitoring data, but the data do not represent CWT wastewaters only. As discussed previously, most CWT facilities commingle CWT wastewaters with non-CWT wastewaters such as industrial wastestreams or stormwater prior to monitoring for compliance. Most CWT facilities with waste receipts in more than one subcategory commingle CWT wastestreams prior to monitoring for performance. Some facility supplied data, therefore, is insufficient for estimating current loadings.

When possible, EPA determined current loadings for an individual facility based on information reported by that facility. For most CWT facilities, however, EPA had to estimate current loadings. EPA's methodology differs depending on the subcategory of CWT facilities and individual facility characteristics. Factors that EPA took into account in estimating current loadings include: 1) the analytical data available for the subcategory; 2) the characteristics of the facilities in the subcategory; and 3) the facility's treatment train. For facilities in multiple subcategories, EPA estimated loadings for that portion of the wastestream in each subcategory and subsequently added them together. The sections that follow discuss the current loadings methodologies for each subcategory.

EPA refers to sample points at specific episodes throughout this chapter. However, diagrams of the sample facilities are not provided. EPA refrained from including the diagrams due to confidentiality concerns. All facility diagrams are available in the record for this rule, with those claimed confidential in the CBI portion of the record.

Current Loadings Estimates for the Metals Subcategory 12.3.1

EPA calculated current loadings for the metals subcategory facilities by assigning pollutant concentrations based on the type of treatment currently in-place at each facility. EPA assigned in-place treatment for this subcategory in one of five classes:

1) raw, or no metals treatment;
2) primary precipitation with solids-liquid separation;
3) primary precipitation with solids-liquid separation plus secondary precipitation with solids-liquid separation;
4) primary precipitation with solids-liquid separation plus secondary precipitation with solids-liquid separation followed by multi-media filtration (EPA based the BPT/BAT/PSES/PSNS limitations and standards for this subcategory on this technology); and
5) selective metals precipitation with solids-liquid separation plus secondary precipitation with solids-liquid separation plus tertiary precipitation with solids-liquid separation (EPA based the NSPS limitations and standards on this technology).

Table 12.1 shows the current loadings estimates for each classification and the following five sections (12.3.1.1 through 12.3.1.5) detail the estimation procedure for each classification.

EPA notes that, due to differences among

datasets used to calculate loading classes, "common sense" reductions of some pollutants with increasing technology are not always displayed in Table 12.1.

Table 12.1 Metals Subcategory Pollutant Concentration Profiles for Current Loadings

Pollutant of Concern	Raw Treatment	Primary Precipitation	Secondary Precipitation	BAT Option Technology	Selective Metals Precipitation
CLASSICAL OR CONVENTIONAL PARAMETERS (mg/L)					
Ammonia as nitrogen	184.34	347.65	112.71	15.63	9.12
Biochem. oxygen demand	1,326.82	5,043.83	670.17	159.60	28.33
Chemical oxygen demand	10,889.83	12,696.25	2,362.67	1,333.33	198.56
Chloride	17,570.78	35,966.67	33,966.67	18,000.00	2,243.75
Fluoride	1,416.38	49.72	82.85	66.27	2.35
Hexavalent chromium	1,364.96	4.02	0.36	0.80	0.03
Nitrate/nitrite	3,243.72	3,102.17	974.93	531.67	12.61
Oil and grease	29.67	75.86	12.11	34.34	34.34
Total cyanide	8.00	1.29	3.64	0.17	N/A[1]
Total dissolved solids	60,992.86	52,040.00	48,400.00	42,566.67	18,112.50
Total organic carbon	1,938.79	3,598.17	451.55	236.33	19.64
Total phenols	1.65	5.57	3.16	N/A[1]	N/A[1]
Total phosphorus	690.21	43.10	39.63	31.68	29.32
Total sulfide	58.17	29.21	17.57	N/A[1]	24.95
Total suspended olids	31,587.34	494.85	673.81	16.80	9.25
METAL PARAMETERS (ug/L)					
Aluminum	362,855	28,264	27,628	856	73
Antimony	80,937	4,152	679	170	21
Arsenic	56,873	181	246	84	11
Beryllium	39	3	8	N/A[1]	1
Boron	119,394	35,047	23,811	8,403	7,290
Cadmium	549,749	254	6,792	58	82
Calcium	1,132,699	4,163,233	308,935	20,000	407,167
Chromium	851,525	3,986	19,125	1,675	40
Cobalt	362,914	214	223	115	57
Copper	2,514,805	1,796	419	744	169
Gallium	5,045	2,473	2,600	N/A[1]	N/A[1]
Indium	11,839	3,820	5,250	N/A[1]	500
Iodine	95,940	15,075	1,000	N/A[1]	N/A[1]
Iridium	51,823	4,554	5,250	500	N/A[1]
Iron	1,210,265	16,076	11,533	5,752	387
Lanthanum	779	413	550	N/A[1]	100
Lead	167,649	1,909	281	177	55
Lithium	67,827	35,757	2,495	1,927	N/A[1]
Magnesium	209,520	6,107	5,035	N/A[1]	753
Manganese	182,587	1,551	1,360	49	12
Mercury	276	21	2	1	0
Molybdenum	51,575	5,833	3,053	1,747	528
Nickel	430,971	20,083	1,668	1,161	255
Osmium	1,917	440	550	N/A[1]	100
Phosphorus	347,146	36,543	1,152,950	27,529	544
Potassium	2,003,938	2,361,444	748,817	410,000	54,175
Selenium	561	277	577	280	56
Silicon	212,884	4,378	2,752	1,447	356
Silver	1,172	223	87	26	5
Sodium	21,329,820	16,662,444	18,921,667	15,100,000	5,776,250

Pollutant of Concern	Raw Treatment	Primary Precipitation	Secondary Precipitation	BAT Option Technology	Selective Metals Precipitation
Strontium	4,818	5,759	1,831	100	N/A[1]
Sulfur	10,754,912	1,802,233	2,203,333	1,214,000	2,820,000
Tantalum	4,924	2,000	2,750	N/A[1]	N/A[1]
Tellurium	16,939	4,000	5,500	N/A[1]	N/A[1]
Thallium	7,556	103	144	N/A[1]	21
Tin	903,260	2,397	434	90	28
Titanium	532,387	152	51	57	4
Vanadium	30,258	45	83	12	11
Yttrium	144	30	43	5	4
Zinc	2,007,752	3,625	2,052	413	206
Zirconium	1,256	1,270	1,330	1,287	N/A[1]
ORGANIC PARAMETERS (ug/L)					
Benzoic acid	1,939	N/A[1]	9,716	3,522	N/A[1]
Benzyl alcohol	1,648	N/A[1]	745	N/A[1]	N/A[1]
Bis(2-ethylhexyl) phthalate	292	645	10	N/A[1]	N/A[1]
Carbon Disulfide	187	N/A[1]	83	N/A[1]	10
Chloroform	64	332	1,418	149	N/A[1]
Dibromochloromethane	64	108	10	50	N/A[1]
Hexanoic acid	215	N/A[1]	23	N/A[1]	N/A[1]
M-xylene	64	N/A[1]	10	N/A[1]	N/A[1]
Methylene chloride	264	165	23	N/A[1]	N/A[1]
N,n-dimethylformamide	131	N/A[1]	76	68	N/A[1]
Phenol	166	6,869	45	N/A[1]	N/A[1]
Pyridine	82	N/A[1]	10	87	N/A[1]
Toluene	166	420	10	N/A[1]	N/A[1]
Trichloroethene	114	108	10	442	N/A[1]
1,1,1-trichloroethane	64	135	10	N/A[1]	N/A[1]
1,1-dichloroethene	64	170	10	N/A[1]	N/A[1]
1,4-dioxane	64	N/A[1]	10	N/A[1]	N/A[1]
2-butanone	323	N/A[1]	61	1,272	N/A[1]
2-propanone	3,712	N/A[1]	246	13,081	N/A[1]
4-methyl-2-pentanone	320	N/A[1]	50	N/A[1]	N/A[1]

[1]Concentration values for certain pollutants were not available for some classifications.

Raw Loadings for the Metals Subcategory *12.3.1.1*

EPA classified metals subcategory facilities with no chemical precipitation in the "raw" class (even if they had other treatment in place, such as activated carbon). EPA assigned the "raw" current loadings estimates to three facilities in the metals subcategory. EPA based its estimates for raw wastewaters on data from 13 sample points at six sampling episodes and one sample point from data supplied by a facility in comments to the 1999 proposal (refer to Table 12-2 for sample episode and sample point identifiers).

The data from these episodes include composite samples from continuous flow systems and grab samples from batch flow systems.

For non-detected measurements, EPA used the sample-specific detection limit except for certain analytes from the semi-quantitative screen component of Method 1620 for episode 1987. In 1990, when these analyses were performed, the laboratory's standard convention to report non-quantitated results from semi-quantitative analysis was to populate the summary form with 'ND' rather than reporting sample-specific limits. This was the case for indium, iridium, lanthanum, osmium, tantalum, and tellurium. With the exception of indium and iridium, EPA used the analyte baseline value for such non-detected results (see chapter 15 for baseline values). For indium and iridium, where the largest detected value was substantially less than the baseline value, EPA used the largest detected value for the non-detected measurements at sample point 2 for episode 1987.

The data from 11 of the 13 sample points from EPA sampling episodes are from batch flow systems. During each day of sampling at these 11 facilities, EPA collected grab samples from one or more batches processed each day by the batch flow systems (for some sample points, EPA did not obtain samples on each day for various reasons such as the treatment associated with that sample point was not used that day). After averaging the values from field duplicate samples, EPA calculated a daily average for each pollutant at each facility. For example, if EPA collected grab samples of two batches during a single day, EPA averaged the two results to obtain the daily average.

Conversely, the data from the remaining two sample points at EPA sampling episodes and the industry effluent monitoring data for facility 652 were all obtained from continuous flow systems. Except for field duplicates and oil and grease/HEM, EPA obtained only one measurement for each day (considered to be the daily average) from a composite sample taken from each continuous flow system. EPA averaged values from duplicate field samples before performing any other calculations. Because oil and grease/HEM can only be obtained as grab samples, EPA typically obtained four samples each day and arithmetically averaged the results to obtain one daily value for that pollutant.

Once EPA obtained the daily averages for each of the sample points, EPA calculated the raw pollutant concentration as the average of the daily averages at the 14 sample points (13 sample points from EPA sampling episode and one sample point from industry supplied effluent monitoring data).

As an illustrative example, Table 12-2 shows the data used to obtain the raw wastewater estimation for aluminum: 362,855 ug/L. Table 12-2 shows that this estimation comes from 38 daily averages (some from continuous systems and some from batch systems) from 91 analyses. Raw wastewater estimations for other pollutants were calculated in a similar manner.

Table 12-2 Example of Metals Subcategory Influent Pollutant Concentration Calculations[1]

Sample Point	Raw Aluminum Daily Averages (ug/L)					# of measurements
Episode 4378-01	389,338	189,223	3,128	8,376		26 (5 are duplicate values)
Episode 4378-03	2,080,000	1,542,500	745,000	70,367	563,250	16 (2 are duplicate values)
Episode 4055-01	51,800	1,670,000	260,000			3
Episode 1987-01	839,000	792,000	859,000			3
Episode 1987-02	577,500	53,400				3 (1 is a duplicate value)
Episode 4393-01	3,730	29,400				2 (1 is a non-detect value)
Episode 4382-07	84,400	139,000	171,000	145,000	330,000	6 (1 duplicate value)
Episode 4393-05	72,400	3,765	6,150	15,900	11,200	6 (1 is a duplicate and non-detect value)
Episode 4803-01	723					1
Episode 4803-03	5,040					1
Episode 4803-05	97,800	1,545,000				3
Episode 4803-07	58,900					1
Episode 4803-10	66,925	101,466	159,250	47,575		20 (4 are duplicate values)
Facility 652-01						no data provided

[1]The Raw Aluminum Concentration is 362,855 ug/L -- the average of daily values in the table.

Primary Precipitation with Solids-Liquid Separation Loadings *12.3.1.2*

EPA estimated pollutant concentrations resulting from primary precipitation and solids-liquid separation using data from EPA sampling episodes and industry supplied effluent monitoring data. EPA used data from three sampling episodes and effluent monitoring data submitted by two facilities. These data were used to represent the current loadings for 32 of the metals subcategory facilities. The episodes used are from the detailed monitoring questionnaire 613 (industry supplied effluent monitoring data), sample point 16; industry effluent monitoring data supplied in comments to the proposal for facility 652, sample point 2; episode 4382, sample point 8; episode 1987, sample point 3; and episode 4798, sample point 3.

For episode 4382, EPA excluded all data for organics, oil and grease, BOD_5, COD, TOC, nitrate/nitrite, and ammonia as nitrogen because they did not represent metals subcategory wastewater exclusively. EPA also excluded data for these analytes from this episode, but different sample points, in calculating the raw loadings (section 12.3.1.1) and the secondary precipitation with solids-liquid separation loadings (section 12.3.1.3).

For non-detected measurements, EPA used the same assumptions as for the data described in section 12.3.1.1. For indium and iridium, where the largest detected value was substantially less than the baseline value, EPA used the largest detected value for the non-detected measurements at sample point 3 for episode 1987.

The facility supplied effluent monitoring data from facility 613 was collected as grab samples from batch flow systems. The facility collected a single grab sample each day. This single value was the daily average for the facility.

Conversely, for this treatment technology, the data from the EPA sampling episodes and the industry effluent monitoring data for facility 652 were all obtained from continuous flow systems. Except for field duplicates and oil and grease/HEM, EPA obtained only one measurement for each day (considered to be the daily average) from a composite sample taken

from each continuous flow system. EPA averaged values from duplicate field samples before performing any other calculations. Because oil and grease/HEM can only be obtained as grab samples, EPA typically obtained four samples each day and arithmetically averaged the results to obtain one daily value for that pollutant.

After calculating daily averages, EPA then calculated a facility average for each pollutant as the arithmetic average of the daily averages at that facility. These facility averages were then arithmetically averaged to obtain the pollutant concentration average. Table 12.1 shows these pollutant average concentrations representing primary precipitation for the relevant pollutants of concern.

Secondary Precipitation with Solids-Liquid Separation Loadings *12.3.1.3*

EPA estimated current loadings for facilities with secondary chemical precipitation using data from three sampling points at three separate episodes and industry supplied effluent monitoring data from one facility. These are episode 4393, sample point 13; episode 4382, sample point 12; episode 4798, sample point 4; and industry effluent monitoring data supplied in comments to the 1995 proposal for facility 652, sample point 3.

All of the data from this treatment technology were obtained from continuous flow systems. EPA used the sample-specific detection limit for all non-detected measurements. Except for field duplicates and oil and grease/HEM, EPA obtained only one measurement for each day from composite samples taken from these continuous flow systems. EPA averaged values from duplicate field samples before performing any other calculations. Because oil and grease/HEM can only be obtained as grab samples, EPA typically obtained four samples each day and arithmetically averaged the results to obtain one daily value for that pollutant.

After obtaining one value for each day, EPA then calculated a facility average for each pollutant as the arithmetic average of the daily averages at that facility. These facility averages were then arithmetically averaged to obtain the pollutant concentration average. Table 12.1 shows these pollutant average concentrations representing secondary precipitation with solids-liquid separation for the relevant pollutants of concern.

Technology Basis for the Option 4 Loadings *12.3.1.4*

EPA used the long-term averages from Metals Option 4 -- batch primary precipitation with solids-liquid separation plus secondary precipitation with solids-liquid separation followed by multi-media filtration -- to represent current loadings at three facilities in the metals subcategory (Chapter 10 describes the method for calculating these long-term averages for each pollutant). The facility sampled by EPA that employs the technology basis for the BPT/BAT/PSES Option, obviously, is assigned its current loadings. EPA modeled the loadings for two facilities that utilize tertiary precipitation with the BPT/BAT/PSES option current loadings. EPA believes that facilities utilizing tertiary precipitation will not need to alter their systems to meet the limitations. By assigning current loadings estimates based on the Option 4 technology basis to the tertiary systems, EPA may have overestimated current loadings at these two facilities. However, EPA does not estimate any post-compliance pollutant reductions at these facilities.

Selective Metals Precipitation (Option 3) Loadings *12.3.1.5*

Only one facility in the metals subcategory utilizes selective metals precipitation. EPA sampled this facility during development of this rule. Therefore, the current loadings pollutant

concentrations for this facility are not estimates, but measured data. Table 12.1 summarizes these pollutant concentrations (Chapter 10 describes the method for calculating the pollutant concentrations).

Current Loadings Estimates for the Oils Subcategory *12.3.2*

Based on questionnaire responses and site visits, EPA found that all facilities which treat oily wastewaters, for which EPA has data, currently employ emulsion breaking and/or gravity separation. If emulsions are present in the incoming waste receipts, the facility first makes use of emulsion breaking. If not, the waste receipts generally bypass emulsion breaking and the facility processes the waste through a gravity separation step for gross separation of the water and the oil phases. A facility may often follow up these pretreatment steps by other wastewater treatment technologies or substitue them for dehydration operations. Therefore, EPA believes that, at a minimum, it may characterize current loadings for oils subcategory discharges by analyzing samples obtained from the effluent of emulsion breaking/gravity separation.

At the time of the 1999 proposal, EPA used seven data sets to represent effluent from emulsion breaking/gravity separation systems. EPA collected these seven data sets during long-term EPA sampling episodes at various types of oily waste facilities. Six of these seven data sets represent facilities that treat oily wastewater and recover/process used oil. One facility, that primarily accepts bilge water, performs oily wastewater treatment only. The annual volume of treated oily wastewater discharged at these facilities ranges from 174,000 gallons/year to 35 million gallons/year. Two of the data sets represent facilities that only accept non-hazardous wastes, while the other five data sets represent facilities which are permitted by RCRA to additionally accept hazardous wastes.

For each pollutant of concern, each of the seven emulsion breaking/gravity separation long-term sampling data sets contains the mean concentration of the data collected over the sampling episode (a duration of two to five days). This mean includes measured (detected) and non-detected values. The value substituted for each non-detected measurement was either 1) the sample-specific detection limit or 2) the average of the measured (detected) values across all seven data sets. Section 12.3.2.1 discusses EPA's representation of non-detect values for this analysis. Section 12.3.2.1 further discusses EPA's representation of the one biphasic sample. For each episode and each pollutant, the table presents the mean concentration of the data collected over the sampling episode. Figure 12-1 shows the procedure EPA used to estimate the mean concentration data over the seven sampling episodes.

EPA has facility-specific information in its database for 84 oils subcategory facilities. Of these 84 facilities, EPA has long-term sampling data for seven and grab sample data for 12 others which were part of the 1998 characterization sampling of oil treatment and recovery facilities (see Chapter 2, section 3.4). For the remainder of the facilities, EPA does not have current loadings data. EPA does, however, have facility-specific information on the volume of wastewater being discharged and the treatment train currently in use. EPA evaluated several ways to associate the emulsion breaking/gravity separation data sets to each of the facilities for which EPA needed to estimate current performance. EPA, therefore, reviewed the data sets to determine if there was a relationship between the concentration of pollutants, and facility flow, but found no evidence of relationship.

Consequently, for the 1999 proposal, EPA randomly assigned one of the seven long-term sampling data sets to each of the facilities that required current loadings estimates. For facilities

which only employ emulsion breaking/gravity separation, EPA estimated current loadings for each pollutant using values in the randomly assigned data set. For facilities which use additional treatment after that step, EPA further reduced the pollutant loadings for certain pollutants (or all pollutants depending on the technology) in the randomly assigned data set to account for the additional treatment-in-place at the facility.

After the 1999 proposal, EPA reevaluated its methodology of randomly assigning data sets to the oils subcategory facilities. EPA determined that it would be more appropriate to assign the same average concentration for each pollutant to all facilities. In calculating these average concentrations for a pollutant, EPA used the seven data sets plus the data from the 11 facilities in the 1998 characterization sampling effort. EPA collected, at a minimum, a single grab sample from emulsion breaking/gravity separation at each facility (for three facilities, EPA collected duplicate field samples and these values were averaged together before any other calculations).

All but one of the EPA sampling episodes were at facilities with continuous flow systems. Except for field duplicates and oil and grease/HEM, EPA obtained only one measurement for each day from composite samples taken from these continuous flow systems. EPA averaged values from duplicate field samples before performing any other calculations. Because oil and grease/HEM can only be obtained as grab samples, EPA typically obtained four samples each day and arithmetically averaged the results to obtain one daily value for that pollutant. EPA calculated the facility average as the arithmetic average of the daily values.

For the one remaining facility that had a batch system, EPA collected grab samples of different batches. EPA averaged the values from duplicate samples before performing any other calculations. EPA then calculated the facility average as the arithmetic average of the batches.

EPA calculated pollutant concentration loadings using RCRA and non-RCRA facilities separately. Each of the 18 facilities was assigned to the RCRA or non-RCRA subset except for one facility which was assigned to both categories. This facility has a RCRA permit to accept and treat RCRA waste, but treated exclusively non-RCRA waste during EPA's sampling. For each pollutant, EPA then calculated an overall pollutant concentration loading for the RCRA subset and another for the non-RCRA subset.

Because the sample sizes of the 18 facilities ranged from a single sample to 20 samples (for the facility with the batch flow system), EPA determined that a weighted average of the facility averages using weights equal to the square root of the sample size would be appropriate. As a simplified, hypothetical example for pollutant X, given two facilities and one had five samples with a facility average of 20 mg/L and the other facility had two samples with a facility average of 100 mg/L, the pollutant average (PA) would be 51 mg/L as shown in the following equation:

$$PA = \frac{\sqrt{5}(20 mg/L) + \sqrt{2}(100 mg/L)}{\sqrt{5} + \sqrt{2}} = 51 mg/L$$

Table 12-7 presents the pollutant concentration loadings (labeled as long-term averages (LTA) in the table) for both the RCRA and non-RCRA subsets.

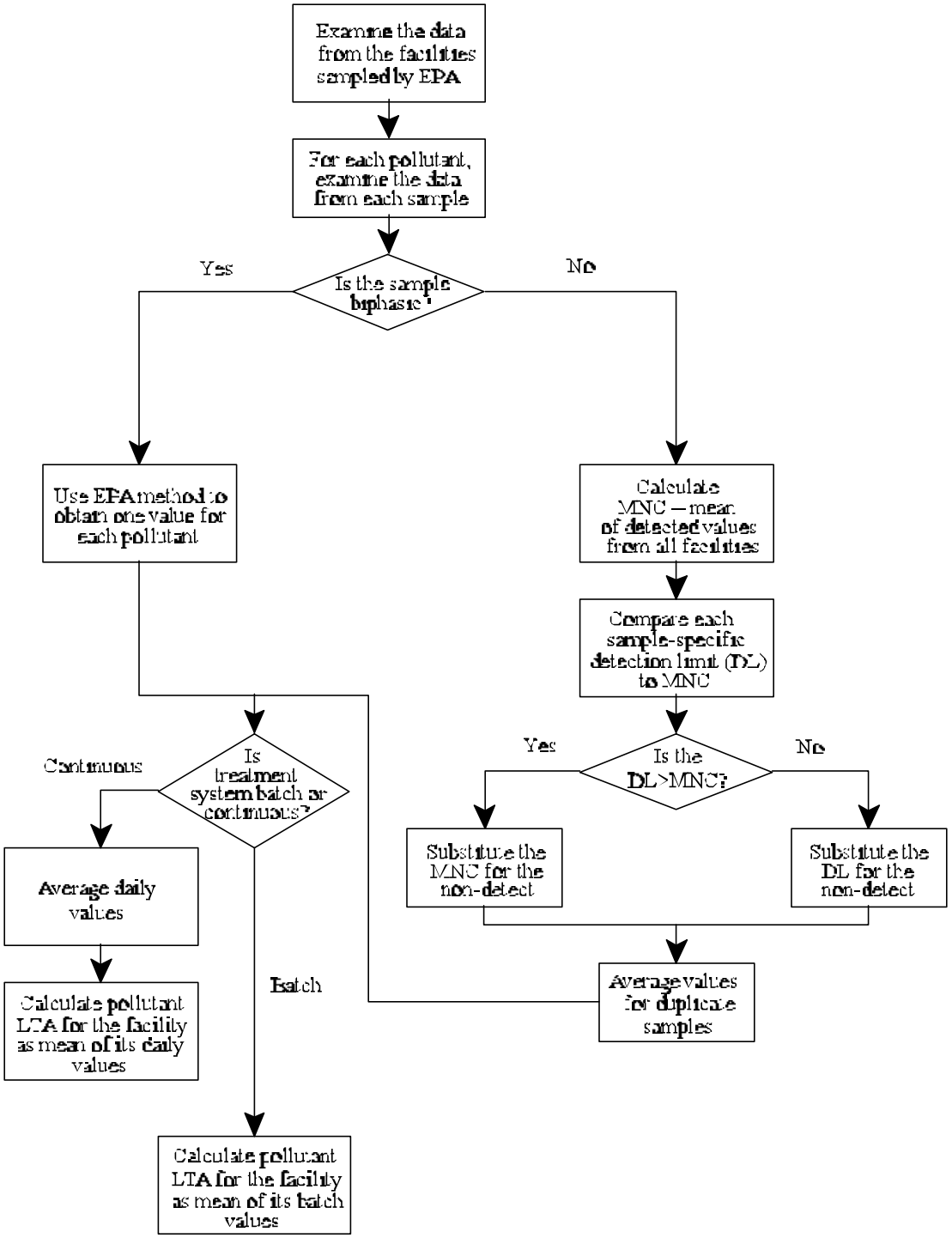

Figure 12-1 Calculation of Current Loadings for Oils Subcategory

TREATMENT-IN-PLACE

As mentioned previously, there are many configurations of treatment trains in this subcategory. While EPA does not have sampling data representing each of these treatment configurations, EPA does have sampling data representing each of the individual treatment technologies currently in place at oily waste facilities. While EPA collected all of the data at CWT facilities, EPA collected some of the data it used to develop treatment-in-place credits at facilities in other CWT subcategories. For some technologies, EPA has sampling data from a single facility, while for others, EPA has sampling data from multiple CWT facilities.

In order to estimate the current pollutant reductions due to additional treatment-in-place at oils facilities, for each technology, EPA compiled and reviewed all CWT sampling data for which EPA collected influent and effluent data. EPA subjected the influent data to a similar screening process as the one used in determining long-term averages. For each episode, EPA retained influent and effluent data for a specific pollutant only if the pollutant was detected in the influent at treatable levels (10 times the baseline value[1]) at least 50 percent of the time. For each facility, EPA then calculated an "average" percent removal for metals (averaging the percent removal for each metal), an "average" percent removal for organics, and an "average" percent removal for BOD_5, TSS, and oil and grease. EPA rounded the averages to the nearest 5 percent. When the "average" percent removal for more than one third of the pollutants in a compound class (i.e., metals, organics, BOD_5, TSS, and oil and grease) was zero or less, EPA set the "average" percent removal for the class of compounds equal to zero. EPA recognizes that treatment technologies are not equally effective in reducing all metals and/or all organics from wastewater, but believes this provides a reasonable estimate. The result is that, for some pollutants, EPA believes it may have underestimated the removals associated with the additional treatment-in-place, while for other pollutants, EPA may have overestimated the removals.

Table 12-3 shows the percent removal credited to each technology. For technologies that EPA evaluated at more than one CWT facility, the value for each class of compounds represents the lowest value at the facilities. For example, EPA sampled at two facilities that use multimedia filtration. The average percent removal of metal pollutants at facility 1 and facility 2 is 60 percent and 30 percent, respectively. Table 12-3 shows that EPA used 30 percent to estimate metals removal in multimedia filtration systems. EPA believes that using the lower percent removal of the "best" performers provides a reasonable estimate of the percent removals of these technologies for the rest of the industry and may even overstate the percent removals for some facilities that may not be operating the treatment technologies efficiently.

For some classes of compounds and some technologies, EPA does not have empirical data from the CWT industry to estimate percent removals. For these cases, EPA assumed percent removals based on engineering judgement. EPA assumed that air stripping is only effective for the removal of volatile and semi-volatile organic pollutants. EPA also assumed that chemical precipitation is ineffective for the treatment of organic pollutants. Finally, EPA assumed a 50 percent reduction in organic CWT pollutants through carbon adsorption treatment. EPA recognizes that carbon adsorption, given the correct design and operating conditions can achieve much higher pollutant removals. However, for this industry, EPA believes that the complex matrices, variability in waste receipts, and high loadings would compromise carbon adsorption

[1]Defined in chapter 15.

performance without regeneration or replacement of the carbon beds based on breakthrough of a range of organic pollutants.

In determining current loadings for facilities with additional treatment-in-place, EPA then reduced the current loadings concentrations established for the facility with gravity separation/emulsion breaking alone by the appropriate percent removal as defined above. For facilities with multiple treatment technologies in their treatment train, EPA credited each of the treatment technologies in the order that the process occurs in their treatment train.

Table 12-3 Treatment-in-Place Credit Applied to Oils Facilities

Pollutant Group	Treatment Technology							
	Chemical Precipitation	Carbon Adsorption	Air Stripping	Ultra-filtration	Biological	Multi-media/Sand Filtration	DAF	Secondary Separtion
BOD_5	0	0	0*	55	50	10	10	5
Oil and grease	45	45	0*	85	65	0	60	30
TSS	85	0	0*	100	50	55	80	0
Metals	75	0	0*	75	15	30	50	0
Organics	0*	50*	70	85	75	0	40	50

*Value is based on engineering judgement.

Issues Associated with Oils Current Performance Analyses *12.3.2.1*

This section describes four issues associated with estimating the current performance of the oils subcategory. The first issue is the dilution required in analyses of some highly concentrated samples representing the baseline technology (emulsion breaking/gravity separation). The second issue is the appropriate procedure for incorporating the concentrations of a biphasic sample into the estimates of current performance. The third issue is the appropriateness of various substitution methods for the non-detected measurements, especially of diluted samples.

Dilution Of Samples During Laboratory Analysis

Effluent from emulsion breaking/gravity separation operations may be highly concentrated, which may present difficulties in analyzing such effluent. Consequently, in its analysis of some samples, EPA needed to dilute the samples in order to reduce matrix difficulties (such as interference) to facilitate the detection or quantitation of certain target compounds. For some organic compounds, EPA also had to dilute samples where a highly concentrated sample could not be concentrated to the method-specified final volume.

If EPA diluted a sample for analytical purposes, EPA adjusted the particular pollutant measurement to correct for the dilution. For example, if a sample was diluted by 100 and the measurement was 7.9 ug/L, the reported value was adjusted to 790 ug/L (i.e., 7.9 ug/L*100). In general, the sample-specific detection limits (DLs) for a pollutant were equal to or greater than the baseline value described in Chapter 15.

Because wastes generated using the BAT technologies will be less concentrated than emulsion breaking/gravity separation operations, in EPA's view, effluent samples collected to demonstrate compliance with the final limitations and standards will not require dilution and therefore not result in effluent values with large sample-specific DLs. Further, a laboratory can

overcome potential analytical interferences using procedures such as those suggested in the *Guidance on the Evaluation, Resolution, and Documentation of Analytical Problems Associated with Compliance Monitoring* (EPA 821-B-93-001). Thus, in demonstrating compliance, EPA would not allow dilution of a sample to a sample-specific DL greater than the limitation or standard.

BIPHASIC SAMPLES

EPA used a number of different analytical methods to determine the pollutant levels in the effluent samples from facilities that employ chemical emulsion breaking/gravity separation for treating oily wastewater. Each method is specific to a particular analyte or to structurally similar chemical compounds such as volatile organics (analyzed by Method 1624) and semivolatile organics (analyzed by Method 1625). In developing the laboratory procedures described in Method 1625, EPA included a procedure for analyzing aqueous samples and another procedure for analyzing biphasic samples. Some effluent samples from emulsion breaking/gravity separation were biphasic. That is, each sample separated into two distinct layers, an aqueous layer and an organic one. In these instances, if the phases could not be mixed, EPA analyzed each phase (or layer) separately. Thus, each pollutant in a sample analyzed by Method 1625 had two analytical results, one for the organic phase and the other for the aqueous phase. There were three such samples in the oils subcategory. Only sample number 32823 (episode 4814B), however, represents oily wastes following emulsion breaking/gravity separation. This sample is part of one of the nineteen data sets representing emulsion breaking/gravity separation used to calculate pollutant concentration loadings for facilities without concentration data. For this biphasic sample, EPA combined the two concentration values into a single value for each pollutant analyzed using Method 1625. The discussion below describes the procedures for combining the two concentration values and Table 12-4 summarizes these procedures. Table 12-5 provides examples of these procedures. DCN[2] 23.13 lists the combined values for the samples.

If the pollutant was detected in the organic phase, EPA adjusted the analytical results to account for the percent of the sample in each phase. For sample 32823, 96 percent of the sample volume was aqueous and the remaining 4 percent was organic. Thus, EPA multiplied the aqueous value (detected value or sample-specific DL) by 0.96 and the organic value by 0.04. EPA then summed the two adjusted values to obtain the total concentration value for the pollutant in the sample.

If the pollutant was not detected in the organic phase, EPA used several different procedures depending on the pollutant and its concentration in the aqueous phase. A factor which complicated EPA's analysis was that sample-specific DLs for pollutants in the organic phase were 1000[3] times greater than the minimum levels for Method 1625. When a measurement result indicates that a pollutant is not detected, then the reported sample-specific DL is an upper bound for the actual concentration of the pollutant in the sample. When some sample-specific DLs for the organic phase (which were 1000 times the minimum level) were multiplied by 0.04, the adjusted non-detected values were greater than the measured amount in the aqueous phase. EPA concluded that substituting the sample-specific DL for the non-detected results in the organic phase in these

[2] Items identified with document control numbers (DCN) are located in the record to the final rulemaking.

[3] Because the volume of the organic phase was small, the organic phase sample required dilution (by 1000) for analysis. In contrast, the aqueous phase had sufficient amount so that it was not diluted.

circumstances might over-estimate the amount of pollutant in the sample. Thus, EPA applied one of the two alternative substitution procedures described below for the sample-specific DLs resulting from the organic phase.

First, if EPA did not detect the pollutant in either phase, EPA considered the sample to be non-detect at the sample-specific DL of the aqueous phase. This value for the aqueous phase was equal to the minimum level specified in Method 1625.

Second, if the pollutant was detected in the aqueous phase (and non-detected in the organic phase), EPA used a procedure that compared the non-detected organic values to the detected aqueous value adjusted by a partition ratio (550). EPA determined this partition ratio using the average of the ratios of the detected organic phase concentrations to the detected aqueous phase concentrations for the pollutants that had detected values in both phases. There were twenty-two pollutants that were used to calculate this value of 550. These pollutants are in four structural groupings of organic pollutants: chlorobenzenes, phenols, aromatic ethers, and polynuclear aromatic hydrocarbons. The ratios were similar in each of the structural groupings; consequently, EPA determined that a single value for the partition ratio was appropriate. EPA then multiplied the aqueous phase concentration value by this partition ratio of 550. If this value was less than the sample-specific DL of the pollutant in the organic phase, EPA substituted this value for the organic phase sample-specific DL. Otherwise, EPA used the organic phase sample-specific DL. EPA then multiplied the values for the aqueous and organic phases by the relative volume amounts (0.96 and 0.04, respectively) and summed them to obtain one value for the sample.

Table 12-4. Biphasic Sample Calculations (Summary of rules for combining aqueous/organic phase concs.)

Censoring types (i.e., detected or non-detected)			Method for obtaining combined value
Aqueous phase	Organic phase	Combined result (same as aqueous)	
NC	NC	NC	0.96*AQ + 0.04*ORG
ND	NC	ND	0.96*AQ (use DL) + 0.04*ORG
ND	ND	ND	AQ (use DL)
NC	ND (DL>550*AQ)	NC	0.96*AQ + 0.04*(550*AQ)
	ND (DL<=550*AQ)		0.96*AQ + 0.04*ORG (use DL)

AQ = value for aqueous phase NC = non-censored (detected)
ORG = value for organic phase ND = non-detected DL = sample-specific detection limit

Table 12-5. Examples of Combining Aqueous and Organic Phases for Sample 32823

Pollutant	Reported Concs. (ug/L)		Concentration for Sample (ug/L)	Calculation for Sample	Comment
	Aqueous Phase	Organic Phase			
Acenaphthene	668.6	319,400	13,418	(0.96*668.6 ug/L) + (0.04*319,400 ug/L)	Concentrations are weighted by relative amounts of the sample volume in each phase: 96% aqueous and 4% organic
4,5-methylene phenanthrene †	ND (10)	163,500	ND (6,550)	(0.96*10 ug/L) + (0.04*163,500 ug/L)	
Aniline	ND (10)*	ND (10,000)	ND (10)		no calculation necessary
1-phenyl -naphthalene ‡	10.49	ND (10,000)	240.9	(0.96*10.49 ug/L) +(0.04*550*10.49 ug/L)	The sample-specific DL of 10,000 ug/L for the organic phase is greater than 5570 ug/L (i.e., 550 times 10.49 ug/L)
Alpha-terpineol	1,885.8	ND (10,000)	2,210	(1,885.8 ug/L*0.96) + (10,000 ug/L*0.04)	The sample-specific DL of 10,000 ug/L for the organic phase is less than 1,037,190 (i.e., 550 times 1885.8 ug/L)

* ND=non-detected measurement. The sample-specific DL is provided in the parentheses.
† None of measurements of the pollutants of concern from this sample resulted in a non-detected measurement for the aqueous phase with a detected measurement for the organic phase. This analyte is shown for demonstration purposes.
‡ None of measurements of the pollutants of concern from this sample resulted in a detected measurement for the aqueous phase with a sample-specific DL for the organic phase that was greater than 550 times the measurement from the aqueous phase. This analyte is shown for demonstration purposes.

NON-DETECT DATA IN COMPLEX SAMPLES

EPA included values for measurements reported as "non-detected" when it calculated the mean for each pollutant of concern in the emulsion breaking/gravity separation data sets. In some instances, the measurements reported as non-detected had sample-specific detection limits that were well in excess of the pollutant's baseline value (defined in section 15). The high sample-specific detection limits occurred because the samples contained many pollutants which interfered with the analytical techniques. EPA considered several approaches for handling these sample-specific non-detected measurements because, by definition, if a pollutant is 'not detected', then the pollutant is either not present at all (that is, the concentration is equal to zero) or has a concentration value somewhere between zero and the sample-specific detection limit (DL).

EPA considered the following five approaches to selecting a value to substitute for non-detected measurements in emulsion breaking/gravity separation samples:

1. Assume that the pollutant is not present in the sample and substitute zero for the non-detected measurement (that is, ND=0).
2. Assume that the pollutant is present in the sample at a concentration equal to the baseline value (BV) for analytical results as defined in chapter 15 (that is, ND=BV)).
3. Assume that the pollutant is present at a concentration equal to half the sample-specific DL (that is, ND=DL/2). (In general, the values of the sample-specific DLs are equal to or greater than the values of the baseline values used in the second approach.)
4. Assume that the pollutant is present at a concentration equal to the sample-specific DL (that is, ND=DL). This is the

substitution approach that was used in the 1995 proposal, for the influent pollutant loadings for the other two subcategories, and for the final limitations and standards for all three subcategories.

5. Assume that the pollutant is present at a concentration equal to either the sample-specific DL or the mean of the detected (or non-censored) values (MNC) of the pollutant.[4] EPA used the lower of the two values (that is, ND=minimum of DL or MNC). For each pollutant, EPA calculated two MNC values: one using the data from the RCRA facilities; the other using data from the non-RCRA facilities. EPA then compared the sample-specific detection limits to the appropriate MNC value depending on whether the facility was RCRA or non-RCRA.

EPA ultimately selected the approach described in 5. The Agency concluded that approach 5 provides the most realistic estimate of current performance from these data sets.

Table 12-6A shows how EPA applied the five substitution approaches to data for hypothetical pollutant X for seven facilities (which were the only ones used when EPA evaluated these methods. For the final rule, EPA included the additional 12 characterization facilities in these calculations and distinguished between RCRA and non-RCRA facilities). The example shows the types of calculations EPA performed in comparing the five approaches for the seven facilities. The example includes facilities that treat wastes on a batch and continuous basis. It also includes a mixture of detected and non-detected measurements as well as duplicate samples. For each facility, the table lists the analytical results reported by the laboratory for pollutant X. If the reported value is non-detected, then this analytical result is identified in the table as "ND" with the reported sample-specific DL in the parenthesis. If the value is detected, the analytical (measured) result is shown in the table and is identical in all five approaches because the substitutions apply only to non-detected values. Finally, for seven facilities, the table shows five long-term averages for pollutant X -- one for each of the five substitution approaches.

[4]For each pollutant measured by Method 1625, EPA calculated the mean (or average) of the detected (or non-censored) values (MNC) using all detected values in the eleven data sets except for the biphasic sample. The substitutions were only applied to non-detected measurements observed in aqueous samples because the non-detected measurements in the biphasic sample were evaluated separately as described in the previous section. While EPA believes that biphasic samples can result from some wastes in this subcategory after processing through emulsion breaking/gravity separation, EPA believes that it is appropriate to use only detected measurements from aqueous samples in calculating the mean that will be compared to each sample-specific DL in aqueous samples.

Table 12-6A. Example of Substitution Methods for Non-Detected Measurements of Hypothetical Pollutant X

Facility	Sampling Day or Batch Number	Reported Values (ug/L)	**Approach 1** ND=0	**Approach 2** ND=BV † (BV=10 ug/L)	**Approach 3** ND=DL/2	**Approach 4** ND=DL	**Approach 5** ND= min(DL,MNC)
A**	Batch 1	99	99	99	99	99	99
	Batch 1	95	95	95	95	95	95
	Batch 2	ND (300)*	0	10	150	300	300
	Batch 3	84	84	84	84	84	84
	Batch 4	258	258	258	258	258	258
		A: LTA	**122**	**125**	**160**	**197**	**197**
B	Day 1	ND (100)	0	10	50	100	100
	Day 2	ND (1000)	0	10	500	1000	315
		B: LTA	**0**	**10**	**275**	**550**	**208**
C	Day 1	57	57	57	57	57	57
	Day 2	84	84	84	84	84	84
	Day 3	26	26	26	26	26	26
		C: LTA	**56**	**56**	**56**	**56**	**56**
D	Day 1	73	73	73	73	73	73
	Day 2 (duplicate)	ND (100)	0	10	50	100	100
	Day 2 (duplicate)	ND (10)	0	10	5	10	10
	Day 3	62	62	62	62	62	62
		D: LTA	**45**	**48**	**54**	**63**	**63**
E	Day 1	411	411	411	411	411	411
	Day 2	257	257	257	257	257	257
	Day 3	79	79	79	79	79	79
	Day 4	ND (1000)	0	10	500	1000	315
	Day 5	ND (220)	0	10	110	220	220
		E: LTA	**149**	**153**	**271**	**393**	**256**
F	Day 1	ND (300)	0	10	150	300	300
	Day 2	320	320	320	320	320	320
	Day 3	44	44	44	44	44	44
	Day 4	47	47	47	47	47	47
	Day 5	180	180	180	180	180	180
		F: LTA	**118**	**120**	**148**	**178**	**178**
G	Day 1	1234	1234	1234	1234	1234	1234
	Day 2	855	855	855	855	855	855
	Day 3	661	661	661	661	661	661
	Day 4	1377	1377	1377	1377	1377	1377
		G: LTA	**1032**	**1032**	**1032**	**1032**	**1032**
	MNC =	315	(MNC = mean of detected values from all seven facilities)				

* ND=non-detected measurement. The sample-specific detection limit is provided in the parentheses.
† BV=baseline value for analytical results – see chapter 15
** The 7 data sets used in this table was expanded to include 19 total data sets for the final rule.

While Table 12-6A provides an example using the five approaches, DCN 23.8 in the record shows the results of the substitution values under the first four approaches to the actual seven concentration data sets from the seven facilities with emulsion breaking/gravity separation. DCN 23.21 shows the results of using the fifth approach. After evaluating the five approaches, EPA preferred Approach 5 because it tended to minimize the effect of

sample-specific large detection levels on the long-term averages while providing reasonable estimates of the actual concentrations. Furthermore, EPA felt that Approach 5 was superior to the other four approaches. In particular, the first and second approaches (substitutions of zero or the BV, respectively, for non-detects) are poor choices because they are likely to provide unrealistically low estimates of the analyte concentrations in samples with high sample-specific detection limits, especially when all detected values are substantially greater than zero and the BV. In addition, the third and fourth approaches (substitution of the sample-specific DL or DL/2, respectively) are poor choices because the substitutions could exceed the detected values in some cases, and thus, possibly could over estimate the concentrations in non-detected measurements. EPA's analyses also show that there is little or no difference in the averages between using the sample-specific DL or half the sample-specific DL for many of the facility/analyte data sets. Thus, EPA has followed the approach outlined in 5 above because it concluded that this approach provides reasonable estimates of the actual concentrations because the substituted values are neither unrealistically low nor exceed the greatest detected value.

Table 12-7 shows the option long-term averages for each pollutant for the RCRA and non-RCRA facilities separately. For each pollutant in each subset (RCRA and non-RCRA), the table provides a long-term average without any replacements and another long-term average where sample-specific detection limits greater than the MNC value have been replaced with the MNC value. DCN XXX provides the facility long-term averages that were used to calculate these pollutant long-term averages.

Table 12-6B shows the relative effects (at the time of the 1999 proposal) of EPA's preferred approach in comparison to Approach 1 on the estimates of priority, conventional, and non-priority pollutant concentrations for baseline loadings and the total removals changes for toxic weighted pollutants. In comparison to Approach 1 (EPA's original method), EPA's preferred (or 'replaced') approach (that is, Approach 5) had little noticeable effect on the baseline loadings for the oils subcategory. In other words, the current loadings are approximately the same using either approach. There is, however, a significant decrease in toxic pound-equivalent removals with EPA's preferred approach. Hence, overall toxic pound-equivalent removal estimates using EPA's preferred approach decreased by approximately 34% from those calculated using its original approach (that is, substituting the sample-specific detection limit for all non-detected measurements). The cost effectiveness document provides more information on toxic pound-equivalent removals.

Table 12-6B. Difference in Oils Subcategory Loadings After Non-Detect Replacement Using EPA Approach*

Priority Metals & Organics Current Loading (percent change)	Non-Priority Metals & Organics Current Loading (percent change)	Conventional Pollutant Current Loading (percent change)	Pound-Equivalent Net Removals (percent change)
- 5	+ 1	0	- 34

* Data is from a comparison performed for 1999 proposal. Final estimates may vary slightly.

Table 12-7. Long-Term Average Concentrations For Emulsion Breaking/Gravity Separation Effluent

Pollutant	CAS Number	LTA for RCRA Facilities		LTA for Non-RCRA Facilities	
		Without Replacement	With Replacement	Without Replacement	With Replacement
CLASSICAL OR CONVENTIONAL PARAMETERS (mg/L)					
Ammonia as nitrogen	7664-41-7	135.37	135.37	111.02	111.02
Biochem. oxygen demand	C-003	7,826.66	7,826.66	14,160.55	14,160.55
Chemical oxygen demand	C-004	44,683.32	44,683.32	75,458.21	75,458.21
Chloride	16887-00-6	2,635.01	2,635.01	31.91	31.91
Fluoride	16984-48-8	69.73	69.73	26.85	26.85
Nitrate/nitrite	C-005	25.69	25.69	6.90	6.90
Oil and grease	C-007	18,690.42	18,690.42	6,130.09	6,130.09
SGT-HEM	C-037	1,442.70	1,442.70	3,467.85	3,467.85
Total cyanide	57-12-5	0.24	0.24	0.02	0.02
Total dissolved solids	C-010	16,363.93	16,363.93	11,124.49	11,124.49
Total organic carbon	C-012	6,243.59	6,243.59	15,661.45	15,661.45
Total phenols	C-020	14.63	14.63	40.85	40.85
Total phosphorus	14265-44-2	1,264.87	1,264.87	3,724.63	3,724.63
Total suspended solids	C-009	6,531.56	6,531.56	5,167.65	5,167.65
METAL PARAMETERS (ug/L)					
Aluminum	7429-90-5	36,941	36,941	49,641	49,641
Antimony	7440-36-0	978	243	774	261
Arsenic	7440-38-2	1,328	1,328	102	80
Barium	7440-39-3	2,491	2,491	664	664
Boron	7440-42-8	156,850	156,850	122,998	122,998
Cadmium	7440-43-9	175	161	43	27
Calcium	7440-70-2	224,357	224,357	183,129	183,129
Chromium	7440-47-3	2,023	2,023	218	218
Cobalt	7440-48-4	6,074	6,074	2,077	2,077
Copper	7440-50-8	10,697	10,697	837	837
Germanium	7440-56-4	12,845	4,349	20,888	20,888
Iron	7439-89-6	219,497	219,497	56,564	56,564
Lead	7439-92-1	6,085	6,085	975	975
Lutetium	7439-94-3	2,385	589	4,178	4,178
Magnesium	7439-95-4	75,066	75,066	131,463	131,463
Manganese	7439-96-5	8,237	8,237	2,758	2,758
Mercury	7439-97-6	7	7	20	20
Molybdenum	7439-98-7	2,725	2,725	4,640	4,640
Nickel	7440-02-0	20,512	20,512	1,228	1,180
Phosphorus	7723-14-0	81,096	81,096	22,987	22,987
Potassium	7440-09-7	670,251	670,251	660,839	660,839
Selenium	7782-49-2	123	112	30	18
Silicon	7440-21-3	41,939	41,939	15,861	15,861
Silver	7440-22-4	563	503	52	8
Sodium	7440-23-5	2,808,044	2,808,044	2,376,236	2,376,236
Strontium	7440-24-6	3,408	1,654	4,181	114
Sulfur	7704-34-9	2,048,228	2,048,228	151,420	151,420
Tantalum	7440-25-7	12,923	4,349	20,888	20,888
Tin	7440-31-5	1,672	1,264	494	151
Titanium	7440-32-6	353	353	71	59
Zinc	7440-66-6	30,887	30,887	14,488	14,488
ORGANIC PARAMETERS (ug/L)					
Acenaphthene	83-32-9	2,109	1,364	325	83
Alpha-terpineol	98-55-5	1,739	1,031	476	304
Aniline	62-53-3	1,209	201	334	108

Pollutant	CAS Number	LTA for RCRA Facilities		LTA for Non-RCRA Facilities	
		Without Replacement	With Replacement	Without Replacement	With Replacement
Anthracene	120-12-7	2,348	1,591	370	182
Benzene	71-43-2	4,572	4,572	520	520
Benzo(a)anthracene	56-55-3	1,563	551	363	167
Benzoic acid	65-85-0	15,419	14,689	15,851	15,851
Benzyl alcohol	100-51-6	1,276	334	1,354	1,329
Biphenyl	92-52-4	1,788	889	1,158	1,158
Bis(2-ethylhexyl)phthalate	117-81-7	51,495	51,495	1,472	1,472
Butyl benzyl phthalate	85-68-7	4,886	4,886	2,370	2,370
Carbazole	86-74-8	2,500	552	629	109
Carbon disulfide	75-15-0	371	257	240	240
Chlorobenzene	108-90-7	283	126	10	10
Chloroform	67-66-3	558	482	10	10
Chrysene	218-01-9	1,708	710	401	252
Dibenzofuran	132-64-9	2,060	1,263	319	66
Dibenzothiophene	132-65-0	1,513	544	416	282
Diethyl phthalate	84-66-2	2,228	1,658	355	206
Diphenyl ether	101-84-8	1,205	122	1,590	1,590
Ethylbenzene	100-41-4	4,964	4,964	403	403
Fluoranthene	206-44-0	3,138	2,433	335	96
Fluorene	86-73-7	2,257	1,513	366	154
Hexanoic acid	142-62-1	5,295	5,254	54,805	54,805
m+p xylene	179601-23-1	1,043	1,043	.	.
m-xylene	108-38-3	7,008	7,008	432	432
Methylene chloride	75-09-2	2,965	2,965	133	133
n,n-dimethylformamide	68-12-2	1,229	407	343	104
n-decane	124-18-5	71,555	71,555	1,969	1,969
n-docosane	629-97-0	2,434	1,712	4,789	4,789
n-dodecane	112-40-3	58,682	58,682	11,095	11,095
n-eicosane	112-95-8	28,807	28,807	1,626	1,588
n-hexacosane	630-01-3	1,892	1,288	557	427
n-hexadecane	544-76-3	106,817	106,817	85,199	85,199
n-octacosane	630-02-4	2,036	1,995	316	94
n-octadecane	593-45-3	66,771	66,771	6,854	6,854
n-tetracosane	646-31-1	2,174	1,771	546	529
n-tetradecane	629-59-4	194,564	194,564	50,390	50,390
Naphthalene	91-20-3	11,560	11,560	3,065	3,065
o+p xylene	136777-61-2	4,660	4,660	494	494
o-cresol	95-48-7	1,695	1,091	1,357	1,327
o-toluidine	95-53-4	1,211	158	322	67
o-xylene	95-47-6	700	700	.	.
p-cresol	106-44-5	1,145	939	1,018	1,018
p-cymene	99-87-6	1,536	824	878	878
Pentamethylbenzene	700-12-9	2,303	1,717	309	309
Phenanthrene	85-01-8	5,654	5,241	937	937
Phenol	108-95-2	6,406	6,345	16,610	16,610
Pyrene	129-00-0	2,719	1,994	1,512	1,512
Pyridine	110-86-1	1,371	483	313	34
Styrene	100-42-5	1,299	329	377	190
Tetrachloroethene	127-18-4	2,238	2,238	1,779	1,779
Toluene	108-88-3	22,758	22,758	1,952	1,952
Trichloroethene	79-01-6	876	876	22	22
Tripropyleneglycol methyl ether	20324-33-8	44,553	43,295	5,008	4,785
1,1,1-trichloroethane	71-55-6	2,078	2,078	54	54

Pollutant	CAS Number	LTA for RCRA Facilities		LTA for Non-RCRA Facilities	
		Without Replacement	With Replacement	Without Replacement	With Replacement
1,1-dichloroethene	75-35-4	370	275	10	10
1,2,4-trichlorobenzene	120-82-1	3,283	2,921	309	309
1,2-dichlorobenzene	95-50-1	1,438	389	309	309
1,2-dichloroethane	107-06-2	352	215	10	10
1,4-dichlorobenzene	106-46-7	1,503	762	309	309
1,4-dioxane	123-91-1	349	312	32	32
1-methylfluorene	1730-37-6	1,529	553	370	220
1-methylphenanthrene	832-69-9	1,557	666	597	561
2,3-benzofluorene	243-17-4	1,218	1,218	415	301
2,4-dimethylphenol	105-67-9	1,266	314	482	369
2-butanone	78-93-3	17,599	17,599	1,081	1,081
2-isopropylnaphthalene	2027-17-0	8,649	8,649	414	296
2-methylnaphthalene	91-57-6	6,955	6,605	2,013	2,013
2-propanone	67-64-1	158,534	158,534	8,453	8,453
3,6-dimethylphenanthrene	1576-67-6	1,194	1,194	418	309
4-chloro-3-methylphenol	59-50-7	12,407	12,407	1,245	1,245
4-methyl-2-pentanone	108-10-1	6,496	6,496	642	642

Estimation of Emulsion Breaking/ Gravity Separation Loadings *12.3.2.2*

For the 1999 proposal, EPA randomly assigned one of the seven emulsion breaking/gravity separation data sets to each oils facility for which EPA needed to estimate current performance; however, the SBREFA Panel raised the concern that this approach may not have resulted in a representative assignment of loadings. For the final rule, EPA has developed another procedure to obtain average concentrations using all seven data sets and the characterization sampling described in Chapter 2.

The following explains EPA's final procedure. To obtain estimates of current pollutant loadings associated with emulsion breaking/gravity separation, EPA developed estimates of the pollutant loadings at each of the 84 facilities identified as having wastestreams in the oils subcategory. To obtain estimates of pollutant loadings, EPA needed concentration and flow information for all facilities. EPA had flow information from all facilities, but had varied data on pollutant concentrations from only nineteen facilities where EPA had sampled the emulsion breaking/gravity separation operations. Section 12.3.2.1 describes these nineteen concentration data sets. For each facility in EPA's oils subcategory database, EPA assigned either the RCRA or non-RCRA long-term average to the facility depending on its RCRA status. Then, EPA estimated each facility's pollutant loadings as the product of the total oils wastewater flow at the facility and the pollutant concentrations in its assigned data set.

Organics Subcategory Current Loadings ***12.3.3***

EPA had limited available data from the organics subcategory and very little data which represent organic subcategory CWT wastewater only. The vast majority of organic facilities commingle large quantities of non-CWT wastewater prior to the point of discharge. Therefore, EPA estimated current loadings based on the treatment technologies in place except for the two facilities for which EPA has analytical data representing organic subcategory wastewater only.

Based on a review of technologies currently used at organic subcategory facilities, EPA placed in-place treatment for this subcategory in

one of five classes:

1) raw;
2) filtration only;
3) carbon adsorption;
4) biological treatment; and
5) biological treatment and multimedia filtration.

The discussion below describes the methodology EPA used to estimate current loadings for each classification. Table 12-8 lists the current performance estimates for each classification. This table does not include current loadings estimates for all pollutants of concern in the organics subcategory.

EPA used the first classification ("raw") for seven organic subcategory facilities with no reported treatment in place for the reduction of organic constituents. EPA based its current loadings estimate for "raw wastewater" on EPA sampling data at two organic facilities. These were Episode 1987, sample points 07A and 07B and Episode 4472, sample point 01. Because the data at Episode 4472 represents both organic and oils subcategory wastes, the raw loadings for metals pollutants were based upon the Episode 1987 data alone[5].

For each episode and sample point, EPA collected one composite sample for the entire day. In addition, EPA collected a few field duplicates that were also composite samples that correspond to the pollutants of concern. EPA then averaged duplicate samples before performing any other calculations so that there was only one daily average for each day for each pollutant of concern.

For each pollutant of concern and each facility, EPA calculated a long-term average as the arithmetic average of the daily averages. This mean includes measured (detected) and non-detected values. For non-detected values, EPA used the sample-specific detection limit. For two cases where the resulted were reported as non-detected, EPA used the baseline value for the pollutant (described in section 15) because the laboratory did not report the sample-specific detection limits. These two cases were for iodine and phosphorus at episode 1987.

Once EPA had calculated the long-term average for each facility and each pollutant of concern, EPA then calculated the mean (that is, arithmetic average) of the long-term averages from the two facilities for each pollutant of concern to estimate the "raw" current loadings concentrations reported in Table 12-8.

EPA classified in the second category ("filtration only") three organic subcategory facilities which only had multi-media or sand filtration as the on-site treatment technology for the organic waste stream. For these facilities, EPA adjusted the "raw wastewater" concentrations to account for 55 percent removal of TSS, 30 percent removal of metal parameters, 10 percent removal of BOD_5, and no removal of other classical or organic pollutants. EPA estimated the percent reductions for facilities in this group using the procedure previously described in Section 12.3.2.

EPA placed in the third category two organic subcategory facilities with carbon adsorption (usually preceded by sand or multi-media filtration). EPA adjusted the "raw wastewater" concentrations to account for 50 percent removal of organic pollutants, and no removal of all other pollutants. Again, EPA also estimated the percent removals for facilities in this category using the procedure previously described in Section 12.3.2.

EPA based the current loadings concentrations for the fourth and fifth classification on EPA sampling data collected at Episode 1987. EPA calculated the current loadings estimates for each pollutant of concern using a similar procedure to that described above

[5] EPA's data show that the concentration of metal pollutants in oils subcategory wastes are generally greater than in organics subcategory wastes.

for the "raw" organics subcategory current performance.

EPA based the percent removals for five organic subcategory facilities in the fourth classification (biological treatment) on analytical data collected at sample point 12 at episode 1987. For the classicals, conventionals, and metals pollutants, if the long-term average at sample point 12 was greater than the value at sample point 7 at episode 1987, EPA used the value of sample point 7. This is because the treatment technology was ineffective for these specific pollutants.

For the two organic subcategory facilities in the fifth classification (biological treatment and multimedia filtration) EPA based removals on analytical data collected at sample point 14 for conventionals, classicals, and metals. EPA based the removals for organics on the data collected at sample point 12 because EPA did not analyze any samples for organics from sample point 14. This is because no additional organics removals were expected between the two treatment steps.

Table 12-8: Organics Subcategory Baseline Long-Term Averages

Pollutant	Raw	Filtration Only	Carbon Adsorption	Biological Treatment	Biological Treatment and Multimedia Filtration
CLASSICAL OR CONVENTIONAL PARAMETERS (mg/L)					
Ammonia as nitrogen	5,680	5,680	5,680	1,060	616.0
Biochem. oxygen demand	24,224	21,802	24,224	2,440	1,564.0
Chemical oxygen demand	75,730	75,730	75,730	3,560	2,940.0
Fluoride	7	7	7	8	2.3
Nitrate/nitrite	93	93	93	2	0.2
Total cyanide	3	3	3	2	2.1
Total organic carbon	31,804	31,804	31,804	1,006	968.0
Total sulfide	4	4	4	3	1.8
Total suspended solids	1,319	725	1,319	480	399.2
METAL PARAMETERS (ug/L)					
Aluminum	4,808	1,442	4,808	2,474	291.0
Antimony	687	206	687	569	92.0
Arsenic	74	22	74	74	80.0
Barium	28,343	8,503	28,343	2,766	1,120.0
Boron	3,490	1,047	3,490	3,490	3,090.0
Calcium	1,249,000	374,700	1,249,000	286,000	641,000.0
Chromium	109	33	109	109	54.0
Cobalt	425	128	425	425	170.0
Copper	910	273	910	704	171.0
Iodine	6,270	1,881	6,270	6,270	5,800.0
Iron	3,833	1,150	3,833	3,833	2,040.0
Lead	340	102	340	314	66.0
Lithium	9,730	2,919	9,730	9,730	9,400.0
Manganese	292	88	292	227	360.0
Molybdenum	1,765	529	1,765	943	253.0
Nickel	1,632	490	1,632	1,632	1,850.0
Phosphorus	5,740	1,722	5,740	5,740	1,700.0
Potassium	973,600	292,080	973,600	973,600	971,000.0
Silicon	2,590	777	2,590	2,590	1,600.0
Sodium	4,459,000	1,337,700	4,459,000	4,459,000	5,310,000.0
Strontium	6,870	2,061	6,870	2,060	6,000.0
Sulfur	1,283,960	385,188	1,283,960	1,283,960	563,000.0
Tin	670	201	670	670	789.0
Titanium	27	8	27	27	19.0
Zinc	781	234	781	382	127.0
ORGANIC PARAMETERS (ug/L)					
Acetophenone	1,481	1,481	741	36	35.9
Aniline	1,350	1,350	675	11	10.5
Benzene	2,765	2,765	1,382	10	10.0
Benzoic acid	9,914	9,914	4,957	320	320.0
Bromodichloromethane	542	542	271	10	10.0
Carbon disulfide	626	626	313	16	16.5
Chlorobenzene	535	535	267	10	10.0
Chloroform	7,039	7,039	3,519	73	72.6
Dimethyl sulfone	1,449	1,449	724	158	157.7
Ethylenethiourea	4,383	4,383	2,192	4,400	4,400.2
Hexachloroethane	1,311	1,311	656	11	10.5
Hexanoic acid	2,051	2,051	1,026	64	64.0
Isophorone	2,006	2,006	1,003	14	13.9

Pollutant	Raw	Filtration Only	Carbon Adsorption	Biological Treatment	Biological Treatment and Multimedia Filtration
M-xylene	1,197	1,197	599	10	10.0
Methylene chloride	1,958,967	1,958,967	979,483	204	204.5
N,n-dimethylformamide	34,838	34,838	17,419	11	10.5
O+p xylene	705	705	352	10	10.0
O-cresol	6,195	6,195	3,098	185	184.8
P-cresol	3,322	3,322	1,661	66	66.2
Pentachlorophenol	6,870	6,870	3,435	791	791.1
Phenol	6,616	6,616	3,308	362	362.0
Pyridine	3,853	3,853	1,927	116	116.5
Tetrachloroethene	3,955	3,955	1,978	112	112.1
Tetrachloromethane	3,087	3,087	1,544	14	14.4
Toluene	746,077	746,077	373,039	10	10.0
Trans-1,2-dichloroethene	1,597	1,597	799	22	21.5
Trichloroethene	6,439	6,439	3,220	69	69.4
Vinyl chloride	775	775	388	10	10.0
1,1,1,2-tetrachloroethane	939	939	469	10	10.0
1,1,1-trichloroethane	1,429	1,429	714	10	10.0
1,1,2,2-tetrachloroethane	1,364	1,364	682	10	10.0
1,1,2-trichloroethane	1,731	1,731	865	13	13.3
1,1-dichloroethane	538	538	269	10	10.0
1,1-dichloroethene	610	610	305	10	10.0
1,2,3-trichloropropane	644	644	322	10	10.0
1,2-dibromoethane	2,406	2,406	1,203	10	10.1
1,2-dichlorobenzene	2,237	2,237	1,118	15	15.1
1,2-dichloroethane	4,478	4,478	2,239	10	10.0
1,3-dichloropropane	533	533	266	10	10.0
2,3,4,6-tetrachlorophenol	3,728	3,728	1,864	629	629.0
2,3-dichloroaniline	1,401	1,401	701	23	23.0
2,4,5-trichlorophenol	1,411	1,411	706	97	96.8
2,4,6-trichlorophenol	1,462	1,462	731	86	85.8
2,4-dimethylphenol	1,402	1,402	701	11	10.5
2-butanone	59,796	59,796	29,898	878	878.1
2-propanone	6,848,786	6,848,786	3,424,393	2,061	2,061.3
3,4,5-trichlorocatechol	10	10	5	1	0.8
3,4,6-trichloroguaiacol	4	4	2	1	0.8
3,4-dichlorophenol	144	144	72	30	30.4
3,5-dichlorophenol	69	69	35	1	0.8
3,6-dichlorocatechol	3	3	2	1	0.8
4,5,6-trichloroguaiacol	14	14	7	1	0.8
4,5-dichloroguaiacol	2	2	1	13	12.9
4-chloro-3-methylphenol	1,342	1,342	671	64	64.0
4-chlorophenol	3,770	3,770	1,885	243	242.5
4-methyl-2-pentanone	3,312	3,312	1,656	146	146.2
5-chloroguaiacol	598	598	299	1,595	1,595.0
6-chlorovanillin	8	8	4	1	0.8

METHODOLOGY USED TO ESTIMATE POST-COMPLIANCE LOADINGS 12.4

Post-compliance pollutant loadings for each regulatory option represent the total industry wastewater pollutant loadings after implementation of the rule. For each option, EPA determined an average performance level (the "long-term average") that a facility with well designed and operated model technologies (which reflect the appropriate level of control) is capable of achieving. In most cases, EPA calculated these long-term averages using data from CWT facilities operating model technologies. For a few parameters, EPA determined that CWT performance was uniformly inadequate and transferred effluent long-term averages from other sources.

To estimate post-compliance pollutant loadings for each facility for a particular option, EPA used the long-term average concentrations, the facility's annual wastewater discharge flow, and a conversation factor in the following equation:

$$\text{Postcompliance long-term average concentration (mg / L)} * \text{Facility annual discharge flow (L / yr)} * \frac{1\text{lb}}{453{,}600\text{mg}} = \text{Facility postcompliance annual loading (lbs / yr)}$$

EPA expects that all facilities subject to the effluent limitations and standards will design and operate their treatment systems to achieve the long-term average performance level on a consistent basis because facilities with well-designed and operated model technologies have demonstrated that this can be done. Further, EPA has accounted for potential treatment system variability in pollutant removal through the use of variability factors. The variability factors used to calculate the limitations and standards were determined from data for the same facilities employing the treatment technology forming the basis for the rule. Consequently, EPA has concluded that the standards and limitations take into account the level of treatment variation well within the capability of an individual CWT facility to control. If a facility is designed and operated to achieve the long-term average on a consistent basis, and if the facility maintains adequate control of treatment variation, the allowance for variability provided in the limitations is sufficient.

Table 12-9 presents the long-term averages for the selected option for each subcategory. The pollutants for which data is presented in Table 12-9 represent the pollutants of concern at treatable levels at the facilities which form the basis of the options. The pollutants selected for regulation are a much smaller subset.

Table 12-9. Long-Term Average Concentrations (ug/L) for All Pollutants of Concern

Pollutant of Concern	Metals Option 3 NSPS	Metals Option 4 BPT/BAT/ PSES/PSNS	Oils Option 8 PSES	Oils Option 9 BPT/BAT/ NSPS/PSNS	Organics Option 4 ALL
Ammonia as nitrogen	9.12	15.63	184.38	97.22	1,060.00
Biochem. oxygen demand	28.33	159.60	7,621.25	7,621.25	41.00
Chemical oxygen demand	198.56	1,333.33	17,745.83	20,490.00	3,560.00
Chloride	2,243.75	18,000.00	1,568.75	1,568.75	
Fluoride	2.35	66.27	36.25	36.25	Failed tests
Hexavalent chromium	0.03	0.80			
Nitrate/nitrite	12.61	531.67	46.21	20.75	2.28
Oil and Grease	Failed tests	34.34	No data	28.33	
SGT-HEM			142.80	42.53	
Total cyanide	Failed tests	0.17	0.11	0.11	2.18
Total dissolved Solids	18,112.50	42,566.67	Failed tests	Failed tests	
Total organic Carbon	19.64	236.33	3,433.75	5,578.88	1,006.00
Total phenols	Failed tests	Failed tests	17.84	20.16	
Total phosphorus	29.32	31.68	37.03	31.36	
Total sulfide	24.95	Failed tests			2.80
Total suspended solids	9.25	16.80	No data	25.50	45.00
Aluminum	72.50	856.33	14,072.50	14,072.50	2,474.00
Antimony	21.25	170.00	103.06	103.06	569.40
Arsenic	11.15	Failed tests[1]	789.33	789.33	Failed tests
Barium			220.50	220.50	Failed tests
Beryllium	1.00	Failed tests			
Boron	7,290.00	8,403.33	22,462.50	22,462.50	Failed tests
Cadmium	81.93	58.03	7.46	7.46	
Calcium	407,166.67	20,000.00	172,787.50	172,787.50	286,000.00
Chromium	39.75	1,674.50	323.40	183.13	Failed tests
Cobalt	57.42	114.50	7,417.04	7,417.04	437.20
Copper	169.03	744.16	256.66	156.75	703.60
Gallium	Failed tests	Failed tests			
Germanium			Failed tests	Failed tests	
Indium	500.00	Failed tests			
Iodine	Failed tests	Failed tests			Failed tests
Iridium	Failed tests	500.00			
Iron	387.21	5,752.34	53,366.67	53,366.67	3,948.00
Lanthanum	100.00	Failed tests			
Lead	55.11	176.75	148.70	98.58	Failed tests
Lithium	Failed tests	1,926.67			Failed tests
Lutetium			Failed tests	Failed tests	
Magnesium	752.54	Failed tests	62,900.00	62,900.00	
Manganese	11.62	48.70	5,406.46	5,406.46	227.00
Mercury	0.20	0.56	3.09	3.09	
Molybdenum	527.69	1,746.67	1,542.75	1,542.75	942.80
Nickel	254.84	1,161.49	1,473.92	1,473.92	Failed tests
Osmium	100.00	Failed tests			
Phosphorus	544.00	27,529.03	44,962.08	44,962.08	Failed tests
Potassium	54,175.00	410,000.00	411,750.00	411,750.00	Failed tests
Selenium	56.25	279.80	107.49	107.49	
Silicon	355.75	1,446.67	19,000.00	19,000.00	2,680.00

Pollutant of Concern	Metals Option 3 NSPS	Metals Option 4 BPT/BAT/ PSES/PSNS	Oils Option 8 PSES	Oils Option 9 BPT/BAT/ NSPS/PSNS	Organics Option 4 ALL
Silver	4.50	26.44	Failed tests	Failed tests	
Sodium	5,776,250.00	15,100,000	Failed tests	Failed tests	Failed tests
Strontium	Failed tests	100.00	774.63	774.63	2,060.00
Sulfur	2,820,000.00	1,214,000.00	Failed tests	Failed tests	1,370,000.00
Tantalum	Failed tests	Failed tests	Failed tests	Failed tests	
Tellurium	Failed tests	Failed tests			
Thallium	20.79	Failed tests			
Tin	28.25	89.77	106.97	106.97	Failed tests
Titanium	3.50	56.87	21.73	21.73	Failed tests
Vanadium	11.00	11.93			
Yttrium	3.50	5.00			
Zinc	206.22	413.27	3,448.54	3,138.75	381.80
Zirconium	Failed tests	1,286.67			
Acenaphthene			137.27	137.27	
Acetophenone					35.87
Alpha-terpineol			48.33	48.33	
Aniline			Failed tests	Failed tests	10.50
Anthracene			164.27	90.71	
Benzene			1,058.81	1,058.81	10.00
Benzo(a)anthracene			106.76	59.71	
Benzoic acid	Failed tests	3,521.67	25,581.42	37,349.63	320.00
Benzyl alcohol	Failed tests	Failed tests	Failed tests	80.65	
Biphenyl			76.21	135.71	
Bis(2-ethylhexyl) phthalate	Failed tests	Failed tests	115.74	62.87	
Bromodichloromethane					Failed tests
Butyl benzyl phthalate			54.98	54.98	
Carbazole			151.45	151.45	
Carbon disulfide	10.00	Failed tests	28.11	28.11	Failed tests
Chlorobenzene			87.48	87.48	Failed tests
Chloroform	Failed tests	148.61	379.09	379.09	72.62
Chrysene			79.43	48.48	
Dibenzofuran			135.25	135.25	
Dibenzothiophene			95.76	59.44	
Dibromochloromethane	Failed tests	50.45			
Diethyl phthalate			759.14	365.93	
Dimethyl sulfone					157.70
Diphenyl ether			Failed tests	981.54	
Ethylbenzene			971.29	423.30	
Ethylenethiourea					4,400.23
Fluoranthene			253.37	17.29	
Fluorene			243.11	129.60	
Hexachloroethane					Failed tests
Hexanoic acid	Failed tests	Failed tests	9,253.62	9,253.62	64.00
Isophorone					Failed tests
M+p xylene			422.95	422.95	
M-xylene	Failed tests	Failed tests	1,520.33	940.96	10.00
Methylene chloride	Failed tests	Failed tests	4,242.03	4,242.03	204.48
N,n-dimethylformamide	Failed tests	68.13	Failed tests	Failed tests	10.50
N-decane			2,369.97	238.16	

Pollutant of Concern	Metals Option 3 NSPS	Metals Option 4 BPT/BAT/ PSES/PSNS	Oils Option 8 PSES	Oils Option 9 BPT/BAT/ NSPS/PSNS	Organics Option 4 ALL
N-docosane			75.33	20.77	
N-dodecane			3,834.84	233.80	
N-eicosane			615.76	51.76	
N-hexacosane			Failed tests	Failed tests	
N-hexadecane			1,386.70	2,551.36	
N-octacosane			Failed tests	Failed tests	
N-octadecane			792.62	202.66	
N-tetracosane			Failed tests	Failed tests	
N-tetradecane			1,820.50	3,303.90	
Naphthalene			1,014.23	248.73	
O+p xylene			1,873.00	1,218.53	Failed tests
O-cresol			Failed tests	1,769.86	184.78
O-toluidine			Failed tests	Failed tests	
O-xylene			268.52	268.52	
P-cresol			630.49	956.84	66.24
P-cymene			55.59	55.59	
Pentachlorophenol					791.15
Pentamethylbenzene			48.33	48.33	
Phenanthrene			649.72	81.76	
Phenol	Failed tests	Failed tests	Failed tests	30,681.00	362.03
Pyrene			131.77	58.00	
Pyridine	Failed tests	86.97	624.78	624.78	116.46
Styrene			56.99	56.99	
Tetrachloroethene			475.45	475.45	112.09
Tetrachloromethane					14.44
Toluene	Failed tests	Failed tests	6,104.68	3,613.18	10.00
Trans-1,2-dichloroethene					21.51
Trichloroethene	Failed tests	441.63	669.61	669.61	69.42
Tripropyleneglycol methyl ether			478.50	478.50	
Vinyl chloride					10.00
1,1,1,2-tetrachloroethane					10.00
1,1,1-trichloroethane	Failed tests	Failed tests	162.78	162.78	10.00
1,1,2,2-tetrachloroethane					Failed tests
1,1,2-trichloroethane					13.30
1,1-dichloroethane					10.00
1,1-dichloroethene	Failed tests	Failed tests	219.48	219.48	10.00
1,2,3-trichloropropane					10.00
1,2,4-trichlorobenzene			117.45	117.45	
1,2-dibromoethane					10.14
1,2-dichlorobenzene			48.33	48.33	Failed tests
1,2-dichloroethane			272.57	272.57	10.00
1,3-dichloropropane					Failed tests
1,4-dichlorobenzene			87.35	87.35	
1,4-dioxane	Failed tests	Failed tests	Failed tests	Failed tests	
1-methylfluorene			48.33	33.65	
1-methylphenanthrene			76.32	54.47	
2,3,4,6-tetrachlorophenol					628.96
2,3-benzofluorene			Failed tests	54.98	
2,3-dichloroaniline					23.04

Pollutant of Concern	Metals Option 3 NSPS	Metals Option 4 BPT/BAT/ PSES/PSNS	Oils Option 8 PSES	Oils Option 9 BPT/BAT/ NSPS/PSNS	Organics Option 4 ALL
2,4,5-trichlorophenol					96.76
2,4,6-trichlorophenol					85.76
2,4-dimethylphenol			Failed tests	Failed tests	Failed tests
2-butanone	Failed tests	1,272.48	11,390.45	11,390.45	878.12
2-isopropylnaphthalene			Failed tests	Failed tests	
2-methylnaphthalene			1,540.02	160.58	
2-propanone	Failed tests	13,081.47	Failed tests	Failed tests	2,061.28
3,4,5-trichlorocatechol					0.80
3,4,6-trichloroguaiacol					Failed tests
3,4-dichlorophenol					30.40
3,5-dichlorophenol					0.80
3,6-dichlorocatechol					Failed tests
3,6-dimethylphenanthrene			Failed tests	52.33	
4,5,6-trichloroguaiacol					Failed tests
4,5-dichloroguaiacol					Failed tests
4-chloro-3-methylphenol			Failed tests	655.39	Failed tests
4-chlorophenol					242.50
4-methyl-2-pentanone	Failed tests	Failed tests	7,848.00	6,624.87	146.16
5-chloroguaiacol					Failed tests
6-chlorovanillin					Failed test

[1]As explained in section 10, EPA used the long-term average from metals option 1A for arsenic even though the option 4 data failed the test.

A blank entry indicates the analyte is not a pollutant of concern for the subcategory.

METHODOLOGY USED TO ESTIMATE POLLUTANT REMOVALS *12.5*

For each regulatory option, the difference between baseline loadings and post-compliance loadings represent the pollutant removals. For direct discharging CWT facilities, this represents removals of pollutants being discharged to surface waters. For indirect dischargers, this represents removals of pollutants being discharged to POTWs less the removals achieved by POTWs. EPA calculated the pollutant removals for each facility using the following equation:

Baseline Loadings – Postcompliance Loadings
= Pollutant Removals

EPA used the following methodology to estimate pollutant removals:

1) If the post-compliance loading of a pollutant was higher than the baseline loading, EPA set the removal to zero;
2) If EPA did not identify a particular pollutant in the wastewater of a facility at baseline and that pollutant was present at baseline in the wastewater of a facility used as the basis for determining limitations and standards associated with one of the regulatory options, EPA set the removal to zero.);
3) If EPA did not calculate a long-term average for a pollutant for a technology option (i.e., the post-compliance loading for the pollutant could not be calculated), EPA set the removal to zero; and
4) For indirect dischargers, EPA additionally reduced the pollutant removal estimate by the POTW removal percentage. Therefore, the pollutant removal estimates for indirect dischargers only account for pollutant removals over and above the POTW removals.

POLLUTANT LOADINGS AND REMOVALS *12.6*

EPA estimated annual baseline and post-compliance loadings for each of the subcategories and the respective regulatory options using the methodology described in Sections 12.3 through 12.5 of this document. For the oils subcategory, EPA extrapolated the facility-specific loadings and removals from the 84 in-scope discharging facilities to provide estimates of an estimated total population of 141 discharging oils facilities. Facilities with no wastewater discharge ("zero dischargers") have no pollutant loadings or removals.

Tables 12-10 through 12-13 present the total baseline and post-compliance loadings and the pollutant removals for the facilities in each subcategory.

Table 12-10. Summary of Pollutant Loadings and Reductions for the CWT Metals Subcategory[1]

Pollutant of Concern	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
CONVENTIONAL OR CLASSICAL PARAMETERS						
Ammonia as N	991,937	N/A	60,504	N/A	931,432	N/A
BOD_5	13,300,815	N/A	576,413	N/A	12,724,402	N/A
COD	35,051,565	N/A	4,791,127	N/A	30,260,438	N/A
Cyanide, total	6,213	497	539	58	5,674	440
HEM (oil & grease)[2]	224,690	N/A	121,568	N/A	103,122	N/A
Hexavalent chromium	169,960	15,789	2,425	2,841	167,535	12,948
Nitrate/nitrite	8,966,661	N/A	1,867,927	N/A	7,098,734	N/A
Phenols, total	17,313	4,760	2,917	660	14,397	4,099
Phosphorus, total	242,069	171,842	129,555	127,905	112,514	43,937
Sulfide, total (Iod.)	111,051	2,690	111,051	2,690	0	0
TDS	191,398,163	190,280,123	160,479,788	158,109,561	30,918,375	32,170,561
TOC	9,580,389	3,693,856	839,288	283,579	8,741,101	3,410,277
TSS	5,533,906	N/A	64,680	N/A	5,469,226	N/A
METAL OR SEMI-METAL PARAMETERS						
Aluminum	137,478	9,521	3,042	299	134,436	9,223
Antimony	20,399	4,839	608	228	19,791	4,611
Arsenic	7,330	297	507	194	6,823	102
Beryllium	20	6	20	6	0	0
Boron	127,035	100,693	34,055	25,900	92,981	74,793
Cadmium	71,235	546	240	23	70,995	523
Calcium	11,008,982	13,016,845	82,743	73,852	10,926,239	12,942,993
Chloride	123,304,754	106,487,827	64,350,877	54,743,908	58,953,877	51,743,920
Chromium	126,679	4,925	5,883	1,330	120,796	3,596
Cobalt	43,211	1,444	437	415	42,773	1,029
Copper	299,047	1,838	2,419	449	296,628	1,389
Fluoride	365,007	103,061	192,226	97,935	172,781	5,126
Iridium	22,404	4,731	2,069	525	20,336	4,207
Iron	192,066	11,439	20,370	4,183	171,696	7,256
Lead	24,634	1,571	654	161	23,980	1,411
Lithium	100,202	90,690	7,971	5,756	92,231	84,933
Magnesium	44,670	20,253	44,670	20,253	0	0
Manganese	26,434	4,068	178	127	26,256	3,941
Mercury	86	7	2	0.2	84	7
Molybdenum	23,596	17,528	6,447	5,717	17,148	11,811
Nickel	101,936	33,817	4,226	2,201	97,710	31,616
Phosphorus	1,166,861	215,032	96,649	33,988	1,070,211	181,044
Potassium	6,805,699	5,095,340	1,468,873	1,001,254	5,336,826	4,094,086
Selenium	1,307	833	1,008	736	300	98
Silicon	38,467	12,245	5,288	4,247	33,179	7,998
Silver	772	94	95	13	677	82
Sodium	64,553,546	66,330,106	56,513,563	59,324,636	8,039,983	7,005,470
Strontium	16,574	17,380	414	344	16,160	17,036
Sulfur	9,513,625	6,341,910	5,022,530	4,199,022	4,491,095	2,142,889
Tin	111,997	5,861	332	208	111,665	5,653
Titanium	62,688	136	195	19	62,493	117
Vanadium	3,733	238	49	44	3,684	194
Yttrium	131	97	20	16	112	81
Zinc	245,781	3,655	1,577	348	244,204	3,307
Zirconium	5,317	2,324	5,278	2,314	39	10
ORGANIC PARAMETERS						
Benzoic acid	16,016	2,331	10,455	1,729	5,562	602

Table 12-10. Summary of Pollutant Loadings and Reductions for the CWT Metals Subcategory[1]

Pollutant of Concern	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
Butanone	1,592	40	1,592	40	0	0
Carbon disulfide	561	132	561	132	0	0
Dibromochloromethane	316	69	172	34	144	36
Methylene chloride	462	261	462	261	0	0
N,n-nitrosomorpholine	240	50	240	50	0	0
N,n-dimethylformamide	453	75	282	42	171	33
Pyridine	278	14	278	14	0	0
Toluene	1,072	54	1,072	54	0	0
Trichloroethylene	572	58	572	58	0	0
1,1-dichlroethene	438	143	438	143	0	0
1,1,1-trichloroethane	352	44	352	44	0	0
2-Propanone	18,231	2,393	18,231	2,393	0	0

[1]All loadings and reductions take into account the removals by POTWs for indirect dischargers.

[2]HEM - Hexane Extractable Material

Table 12-11. Summary of Pollutant Loadings and Reductions for the CWT Oils Subcategory[1]

Pollutant of Concern	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
CONVENTIONAL OR CLASSICAL PARAMETERS						
Ammonia as Nitrogen	11,783	499,382	11,783	499,382	0	0
BOD_5	1,502,944	N/A	1,411,602	N/A	91,343	N/A
COD	8,008,834	N/A	4,032,459	N/A	3,976,375	N/A
Cyanide, Total	3	137	3	84	0	54
HEM (and O&G)[2]	206,539	N/A	5,574	N/A	200,965	N/A
Nitrate/Nitrite	732	N/A	732	N/A	0	N/A
Phenols, Total	924	32,528	924	22,118	0	10,410
Phosphorus, Total	547,900	14,017,083	6,171	309,268	541,729	13,707,815
SGT-HEM	116,841	N/A	8,370	N/A	108,472	N/A
TDS	1,180,709	N/A	1,180,709	N/A	0	N/A
TOC	1,662,244	N/A	1,097,930	N/A	564,314	N/A
TSS	428,553	N/A	96,593	N/A	331,960	N/A
METAL OR SEMI-METAL PARAMETERS						
Aluminum	7,302	19,032	2,714	8,729	4,589	10,303
Antimony	38	412	19	234	19	178
Arsenic	12	845	12	589	0	256
Barium	98	2,814	42	754	56	2,061
Boron	18,093	499,752	14,479	372,148	3,615	127,604
Cadmium	4	35	1	6	3	30
Chromium	32	800	32	301	0	500
Cobalt	306	15,055	306	15,055	0	0
Copper	123	3,239	22	325	101	2,914
Germanium	3,073	37,018	3,073	37,018	0	0
Iron	8,321	98,443	4,275	55,072	4,046	43,371
Lead	143	2,989	19	280	124	2,709
Magnesium	19,339	468,308	11,369	342,703	7,970	125,605
Manganese	406	14,539	406	12,004	0	2,534
Mercury	3	7	1	2	2	5
Molybdenum	683	15,709	291	8,521	392	7,188
Nickel	174	18,430	174	3,785	0	14,645
Phosphorus	3,381	63,798	3,381	48,447	0	15,351
Selenium	3	161	3	157	0	4
Silicon	2,333	87,686	2,333	64,452	0	23,234
Silver	1	101	1	101	0	0
Strontium	17	2,658	17	1,616	0	1,042
Sulfur	22,274	3,338,602	22,274	3,338,602	0	0
Tin	22	1,486	19	397	3	1,089
Titanium	9	64	4	14	5	50
Zinc	2,131	20,399	399	5,666	1,732	14,734
ORGANIC PARAMETERS						
Acenapthene	2	38	2	11	0	27
Alpha-terpinol	7	133	7	117	0	16
Aniline	2	40	2	40	0	0
Anthracene	4	126	4	43	0	83
Benzene	12	427	12	221	0	206
Benzo(a)anthracene	4	32	4	17	0	15
Benzoic Acid	358	13,156	358	13,156	0	0

Table 12-11. Summary of Pollutant Loadings and Reductions for the CWT Oils Subcategory[1]

Pollutant of Concern	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
Benzyl alcohol	30	958	16	958	14	0
Biphenyl	26	173	26	24	1	150
Bis(2-ethylhexyl) phthalate	33	31,747	12	388	21	31,360
Butyl benzyl phthalate	54	793	11	26	43	767
Carbazole	2	425	2	260	0	165
Carbon disulfide	5	171	5	37	0	135
Chlorobenzene	0	8	0	6	0	1
Chloroform	0	193	0	167	0	26
Chrysene	6	55	6	19	0	36
Di-n-butyl phthalate	0	9	0	9	0	0
Dibenzofuran	1	45	1	13	0	32
Dibenzothiopene	6	247	6	105	0	141
Diethyl phthalate	5	1,209	5	841	0	369
Diphenyl ether	36	106	36	106	0	0
Ehtylbenzene	9	520	9	230	0	290
Fluoranthene	2	2,189	2	581	0	1,608
Fluorene	3	796	3	331	0	465
Hexanoic acid	1,239	26,763	1,239	8,878	0	17,885
O+p-xylene	11	2,835	11	1,830	0	1,005
N-decane	45	99,608	45	11,667	0	87,941
N-docosane	108	1,972	4	75	104	1,897
N-dodecane	251	5,811	46	1,421	205	4,390
N-eicosane	36	3,525	10	342	26	3,183
N-hexacosane	10	899	10	899	0	0
N-hexadecane	1,926	116,435	502	3,343	1,424	113,092
N-octadecane	155	33,731	40	1,894	115	31,837
N-tetracosane	12	1,187	12	1,187	0	0
N-tetradecane	1,139	123,887	650	4,393	489	119,494
N,n-dimethylformamide	2	116	2	116	0	0
Naphthalene	69	1,364	49	406	20	958
O-cresol	30	2,588	30	2,588	0	0
M-xylene	10	563	10	255	0	308
P-cresol	23	1,226	23	966	0	260
P-cymene	20	8	11	1	9	7
Pentamethylbenzene	7	297	7	35	0	262
Phenanthrene	21	528	16	209	5	319
Phenol	376	2,735	376	2,735	0	0
Pyrene	34	1,174	11	176	23	999
Pyridine	1	37	1	37	0	0
Styrene	4	65	4	27	0	39
Tetrachloroethylene	40	1,297	40	546	0	751
Toluene	44	1,477	44	787	0	690
Trichloroethene	0	175	0	149	0	26
Tripropyleneglycol methyl ether	108	36,509	93	1,888	16	34,620
1-methylfluorene	5	223	5	60	0	163
1-methylphenanthrene	13	402	11	95	2	307
1,1-dichloroethene	0	128	0	128	0	1
1,1,1-trichloroethane	1	303	1	61	0	242
1,2-dichloroethane	0	37	0	17	0	21

Table 12-11. Summary of Pollutant Loadings and Reductions for the CWT Oils Subcategory[1]

Pollutant of Concern	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
1,2,4-trichlorobenzene	7	435	7	58	0	377
1,4-dichlorobenzene	7	956	7	319	0	637
1,4-dioxane	1	296	1	296	0	0
2,3-benzofluorene	7	239	7	239	0	0
2,4-dimethylphenol	8	747	8	747	0	0
2-methylnaphthalene	46	11,115	32	6,500	14	4,615
2-phenylnaphthalene	3	317	3	317	0	0
2-propanone	191	41,345	191	41,345	0	0
3,6-dimethylphenanthrene	7	407	7	407	0	0
4-chloro-3-methylphenol	28	7,996	28	7,996	0	0
4-methyl-2-pentanone	15	1,369	15	1,369	0	0

[1]All loadings and reductions take into account the removals by POTWs for indirect dischargers.

[2]HEM - Hexane Extractable Material

Table 12-12. Summary of Pollutant Loadings and Reductions for the CWT Organics Subcategory[1]

Pollutant of Concern	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
CONVENTIONAL OR CLASSICAL PARAMETERS						
Ammonia as N	138,389	1,076,771	138,389	582,889	0	493,881
BOD_5	318,555	833,340	318,555	488,569	0	344,770
COD	464,777	4,396,709	464,777	2,033,935	0	2,362,774
Cyanide	285	308	285	278	0	31
TOC	131,339	2,934,599	131,339	1,332,109	0	1,602,490
TSS	62,667	42,088	62,667	26,739	0	15,350
METAL OR SEMI-METAL PARAMETERS						
Aluminum	323	312	323	277	0	35
Antimony	74	57	74	50	0	7
Calcium	37,339	276,063	37,339	121,864	0	154,199
Cobalt	57	92	57	92	0	0
Copper	92	40	92	35	0	6
Iron	515	457	515	457	0	0
Manganese	30	143	30	136	0	7
Molybdenum	123	381	123	264	0	117
Silicon	350	724	350	724	0	0
Strontium	269	1,835	269	1,118	0	717
Sulfur	178,861	356,145	178,861	356,145	0	0
Zinc	50	50	50	35	0	15
ORGANIC PARAMETERS						
Acetophenone	5	20	5	9	0	12
Benzene	1	120	1	95	0	25
Chloroform	9	942	9	618	0	324
Hexanoic acid	8	99	8	44	0	56
Methylene chloride	27	262,279	27	105,492	0	156,788
M-xylene	1	637	1	565	0	72
O-cresol	24	863	24	363	0	500
Pentachlorophenol	103	1,758	103	841	0	917
Phenol	47	92	47	40	0	52
Pyridine	15	52	15	22	0	30
P-cresol	9	277	9	115	0	161
Tetrachloroethene	15	407	15	304	0	104
Tetrachloromethane	2	289	2	224	0	65
Toluene	1	8,377	1	3,387	0	4,990
Trans-1,2-dichloroethene	3	570	3	490	0	80
Trichloroethene	9	443	9	297	0	147
Vinyl chloride	1	114	1	105	0	9
1,1,1,2-tetrachloroethane	1	796	1	723	0	73
1,1,1-trichloro ethane	1	182	1	159	0	24
1,1,2-trichloroethane	2	879	2	747	0	132
1,1-dichloroethene	1	412	1	386	0	26
1,2,3-trichloropropane	1	1,596	1	1,490	0	105
1,2-dibromoethane	1	1,821	1	1,473	0	348
1,2-dichloroethane	1	307	1	221	0	86
2,3,4,6-tetrachlorophenol	82	739	82	375	0	364
2,3-dichloroaniline	3	252	3	109	0	143
2,4,5-trichlorophenol	13	302	13	136	0	166
2-butanone	115	1,011	115	661	0	351
2-propanone	269	362,747	269	167,960	0	194,787
4-methyl-2-pentanone	19	1,022	19	955	0	67

[1]All loadings and reductions take into account the removals by POTWs for indirect dischargers.

Table 12-13. Summary of Pollutant Loadings and Reductions for the Entire CWT Industry[1]

Pollutant of Concern[2]	Current Wastewater Pollutant Loading (lb/yr)		Post-Compliance Pollutant Loading (lb/yr)		Post-Compliance Pollutant Reductions (lb/yr)	
	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers	Direct Dischargers	Indirect Dischargers
CONVENTIONALS	21,578,700	N/A	2,657,700	N/A	18,921,000	N/A
PRIORITY METALS	901,300	99,800	18,000	17,100	883,300	82,700
NON-CONVENTIONAL METALS[3]	1,018,500	1,565,400	171,900	992,000	846,500	573,300
PRIORITY ORGANICS	3,900	326,700	3,700	122,700	100	204,000
NON-CONVENTIONAL ORGANICS	44,200	915,100	35,900	295,200	8,300	619,900

[1]All loadings and reductions take into account the removals by POTWs for indirect dischargers.
[2]Note the following are not included: cyanide, total phosphorus, total phenols, TOC, COD, TDS, Ammonia as N, and other nonconventional classical parameters
[3]Does not include calcium, chloride, fluoride, phosphorus, potassium, sodium, and sulfur